INSULATOR RECOMMENDATIONS

LOCKE INSULATOR CORPORATION, BALTIMORE, MARYLAND

INSTRUCTIONS GEI-13229

RADIO INFLUENCE VOLTAGE COUPLING EQUIPMENT FOR 130 KV CAT. NO. 5232150

LOCKE INSULATOR COMPANY

REQUISITION BAL-66159

GENERAL ELECTRIC COMPANY

SCHENECTADY, N.Y.

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This apparatus is designed for measurement of radio noise over the frequency range of 600 to 1500 kc at 60-cycle potentials up to 130 kv. It complies with the recommendations outlined in NEMA Publication No. 107, 1940. The equipment is built so that it in itself does not produce radio noise. It provides at least 30 db attenuation to any radio noise voltage produced by the high potential test transformer or directly picked up by the high potential leads. It provides, through a coupling capacitor, a 600-ohm resistive impedance at the chosen radio frequencies. The radio noise voltage caused by the test object appears across this impedance and is measured by a suitable radio noise meter. The radio noise meter is not part of the equipment furnished.

The apparatus consists of:

1. High voltage lead structure
2. Coupling capacitor and radio frequency choke
3. Compensator unit
4. Switch box

1. High Voltage Lead Structure

A 20-foot, 2-inch outside diameter, length of thin-walled aluminum tubing is supplied. It is terminated at each end in a 5 1/2-inch brass sphere, nickel-plated. One sphere has a cut-in hole to slip over a stud on the high voltage transformer bushing. The other sphere is interconnected by six

inches of plated brass pipe to a like sphere which fits into a wooden socket. A hinged boom of treated wood 12 feet long holds the lead horizontal. The ball and socket joint on the end of the boom makes it possible to lift the lead from the high voltage bushing and swing the boom horizontally, so that the entire assembly lies against the wall, with the transformer end of the high voltage lead supported by a wall bracket. It is important to avoid striking or otherwise marring the surface of the tubing, or corona may result.

From the lower sphere of the swivel joint assembly on the end of the boom is attached a length (about 16 feet) of 2 1/2-inch diameter flexible metal hose. The floor end of this flexible tubing bears a sleeve fitting which slides over the stud on the top corona shield of the radio noise coupling capacitor.

2. Coupling Capacitor and Radio Frequency Choke

The coupling capacitor is rated at 0.0025 mu f, 130 kv, 60 cycle service, indoor, continuous operation.

It is mounted in a vertical position on a low triangular wooden base with swivel locking wheels. To cover the metallic end plates and clamping rings of the capacitor (the body of the capacitor is a herkolite cylinder 54 inches long and 9 inches in diameter) a lower and an upper corona shield are furnished. The corona shields are aluminum spinnings. The lower shield is set down on the upper surface of the base and

is interconnected to the capacitor end plate. The upper shield contains the radio frequency choke. The upper assembly may be removed as a unit by counterclockwise horizontal rotation. It should always be removed when the capacitor is being lifted. The capacitor should not be lifted by means of its top stud. A sling is provided. There are three eyebolts in the corners of the base. The sling has a short central link to screw to the top stud of the capacitor. This link is adjusted so that it does not draw taut. Its purpose is to make it impossible to upset the capacitor in lifting. The capacitor should be kept upright. It must not be turned on its side. It is possible (though not probable) that air from the expansion space may lodge in a region of high stress with the capacitor on its side, and result in radio noise through corona.

A threaded stud is mounted on the side of the corona shield for attachment of the test piece lead. The test piece lead, a 12-ft. length of 2-inch flexible metal conductor is terminated in a 5 1/2-inch sphere. The corona shield end is fitted with a swivel joint so that it can be made up against the threaded stud. A length of pipe (not supplied) of proper diameter to be corona-free at the test voltage may be substituted for this lead.

3. Compensator Unit

The lower end of the coupling capacitor is connected to ground through a compensator unit. This unit is of negligi-

ble impedance to 60 cycles. It provides a ground at 60 cycles, for protection of the operator, to the lower end of the coupling capacitor. About 122 milliamperes of capacitor charging current flows through the unit. At certain chosen radio frequencies, however, the compensator unit is a 600-ohm resistive impedance.

The coupling capacitor and the compensator unit are interconnected with a 15-foot length of shielded low capacitance cable. The shield of this cable is tied to the metal trim and wheels of the capacitor base. The inner conductor is tied to the capacitor and the lower corona shield. To provide more mechanical strength, the shielded cable is run through a length of rubber tubing which is clamped to the compensator unit and to the socket on the coupling capacitor base.

The compensator unit is housed in a steel cabinet. A heavy braid conductor to the common laboratory ground should be soldered to the brass strap projecting from the rear of the cabinet. For obvious reasons of safety it is essential that this ground connection should be well made and never removed while the coupling transformer is in the high voltage circuit.

Operation of Compensator

There are two knobs on the panel face of the compensator unit. The upper dial is marked "Frequency-Kilocycles". It has nine graduations (600 to 1500). If a measurement is to

be made at 1000 kc, this dial is set to 1000, and the lower dial, marked "Tuning", is varied until a maximum is obtained on the radio noise meter. The reading of the noise meter, times a multiplying factor, is the radio noise voltage caused by the test object appearing across 600 ohms.

The compensator unit provides a 600-ohm resistive impedance at radio frequencies across which the radio noise voltage is to be measured. (See NEMA Publication No. 107.) To provide a 600-ohm standard load across which the radio noise voltage produced by the test piece appears, all inductive and capacitive reactances inherent in the circuit of sufficient magnitude to cause error must be nullified and 600 ohms resistive impedance must be presented. The compensator unit is of extremely low impedance to 60 cycles. (Refer to drawing H-6871234.)

A radio frequency choke is inserted in the circuit between the 60-cycle source, the high potential transformer, and the sink, the test piece. For radio frequency voltages the source is the test piece and the compensator unit, the sink. The choke is of 2.3 millihenrys. It is of negligible impedance to 60 cycles. Over the broadcast range it offers to radio noise, voltages produced by the transformer or directly picked up by the high voltage lead to the coupling capacitor an impedance of at least 20,000 ohms. Due to the position of the radio frequency choke in the circuit, radio noise voltage produced by

the test object appears at the compensator unit and is not by-passed to ground by the capacitance of the secondary winding of the high potential testing transformer. The choke is shielded so that there will be no radio frequency voltages induced in it, either from the radio noise voltage source, the test piece, or from extraneous sources. The test lead and the shield itself are necessarily without shielding from extraneous radio frequency voltages. The radio frequency choke is mounted, in its shield, directly on top of the coupling capacitor. Choke shield and test lead are connected to the coupling capacitor.

The coupling capacitor is 2500 micromicrofarads nominal capacitance. Its 60-cycle impedance is about 10^6 ohms; at 130 kv its burden on the transformer is 0.122 ampere. Its capacitive reactance at 600 kc is approximately 106 ohms. With increase in frequency and with approach to its internal resonant frequency this quadrature component becomes less. Its effect is eliminated by inserting into the series circuit an equivalent amount of inductive reactance. This inductance is tapped. At 1000 kc and above, it is not required. The inductance was adjusted to obtain series resonance with the coupling capacitor. At 600 kc this inductance was approximately 28 microhenrys. To avoid switching surges (dirt on contacts, etc.) it was shunted by a high impedance (2.3 millihenrys) which was permanently connected across the tapped

inductor.

A film gap, placed directly across the entire compensating circuit, provides additional protection to the operator. A piece of cigarette paper should be inserted between its blades. The 2.3 millihenry shunt mentioned above prevents the film gap from failing unnecessarily.

So far, a low impedance has been presented to the signal appearing at the test piece. However, since the series coil and condenser are of finite Q, even at resonance, there will be introduced a small resistive component. This will be taken care of in the multiplying factor which has been supplied.

Since it is difficult to obtain a 600-ohm resistance element at radio frequencies which is also a safe grounding link at 60 cycles, a parallel resonant circuit is formed across which a carbon resistor may be used with safety. The inductance of this parallel resonant circuit is a 13-microhenry coil of heavy wire. It is resonated by the capacity of the shielded lead, stray capacitances to ground, fixed silvered mica capacitors and the variable capacitor marked "Tuning". Under the condition of maximum noise meter response (which occurs at resonance of this circuit) the parallel product of the impedance of the circuit (which includes the conductance of the shielded lead to ground, as well as its capacitance) is adjusted to plus or minus 3 per cent of 600 ohms by the carbon resistors. The L, C, and R changes neces-

sary for each frequency are ganged to the one switch, marked "Frequency-Kilocycles".

No servicing should be necessary in this unit, other than to keep switches in running order. No values are given for the L, C, and R quantitites, since they must be adjusted in any replacement by use of a radio frequency bridge.

4. Switch Box

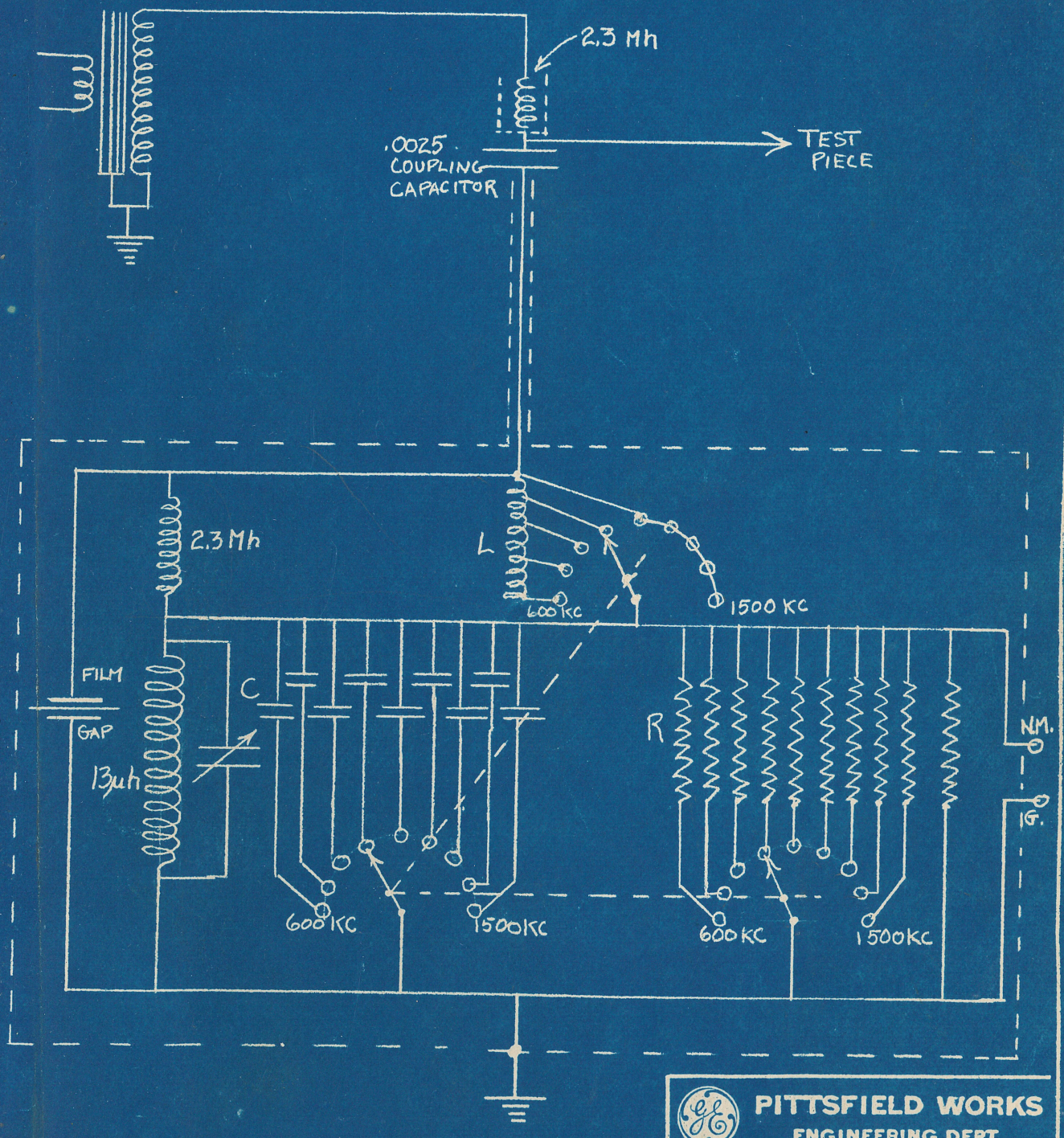
A switch box is supplied. It contains a switch for the relay of laboratory lights, and motor-generator controls and indicators.

Drawing Reference:

H-6871234

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Title G.E. Radio Noise Measuring Equipment, Serial No. 38348



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